Concurrent Validity and Sensitivity of a New Inertial Sensor: Measures of Balance

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Recent data suggest that competitive football players who sustain a concussion during the season are three times more likely to sustain another concussion in the same season when compared to their un-concussed teammates. Poor balance may be a factor leading to this increase in re-injury rate. Devices such as force-plates or the Biodex Balance System have been widely used to measure balance in the clinic or laboratory setting. However, these methods and devices are very costly, difficult to transport, and require expertise to score and interpret results. A new inertial sensor (Mi Sensor) may provide a cost effective, easy to use, and portable solution to measuring balance for collegiate athletes if found to be sensitive and valid. Correlations between the Mi Sensor and gold-standard measures (force-plate and rigid-body movement of L4-L5 segment) have not been established. **PURPOSE:** To determine the concurrent validity (correlation) and sensitivity of an inertial sensor device in measuring a set of balance tasks. **METHODS:** Ten subject volunteers between the ages of 20-34 consented to participate in the study. The subjects included four males and seven females with an average height, weight, and BMI of 171.7cm, 67.4kg, 23.3kg/m^2, respectively. For the validity assessment, subjects were asked to complete three different balance tasks while data was collected from a force-plate (Kistler), motion capture system (Vicon) and the inertial sensor (Mi Sensor). For the sensitivity assessment subjects were asked to perform eight different balance tasks wearing the inertial sensor. **RESULTS:** Concurrent Validity: across the conditions tested the inertial sensor measures were significantly ($p<0.001$) correlated with the force-plate ($r=0.79$) and significantly ($p<0.001$) correlated with the rigid body movement of L4-L5 segment ($r=0.88$). Sensitivity: there was a significant ($p<0.001$) main effect for differences across the 8 balance tasks. **CONCLUSION:** While being cost effective and portable, the new inertial sensor shows promise for being a valid tool in the assessment of balance compared to force-plates and motion analysis. Additionally, the inertial sensor appears sensitive to differences in balance tasks when tested in a healthy sample of young adults.
Inertial sensor for testing provided by: Motion Intelligence, LLC (Ithaca, NY)